ANALYSIS OF INTRASPECIFIC VARIATION IN LOPHOPODELLA CARTERI (HYATT) FROM THE TAXONOMICAL VIEW-POINT IX. ADDITIONAL OBSERVATIONS ON THE VARIATION OF TENTACLE NUMBER

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ANALYSIS OF INTRASPECIFIC VARIATION IN *LOPHOPODELLA CARTERI* (HYATT) FROM THE TAXONOMICAL VIEW-POINT

IX. ADDITIONAL OBSERVATIONS ON THE VARIATION OF TENTACLE NUMBER[1)]

By

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1. INTRODUCTION

The writer stated that the tentacles of *Lophopodella carteri* showed a wide variation in number when the colonies originating from one colony were reared in the laboratory through out the year (1964, Report VI). The variation was also recognized in the field material at Higashi Sendai where only one intraspecific group was found. It was thought that the number of tentacles varied by the influence of water temperature, but further observations showed that variation in tentacle number was sometimes independent of water temperature. For example, the tentacles decreased in number when the colonies from the field were reared in the laboratory, which suggested that factors other than temperature were involved. Therefore, more minute observations became necessary to analyze the problem of the intraspecific groups. The results of these more detailed observations are reported in this paper.

2. THE RELATION BETWEEN WATER TEMPERATURE AND TENTACLE NUMBER

An observation was made in 1965 to find how the tentacle number varied under the temperatures of 22°C and 30°C, since the colonies in the reservoirs, in most cases, lived within this temperature range.

Observation 1

Material: – The materials used were from the reservoirs Saijô II near Hiroshima City and Yohei-numa in Sendai City.

Vessels used: – 7.5 cm in diameter, 6.0 cm in height

Rearing method: – One colony of each material was divided into two pieces, and

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they were reared at 22°C and 30°C respectively. The water was renewed once a day with pond water to which were added the protozoans, *Chilomonas paramecium* and *Colpidium colpoda* together with their culture solution.
Results: – The number of tentacles was as follows.

Date examined	Material	Temperature	Tentacles (mean)	Number of readings
IV, 1st, 1965	Saijô II	22°C	72.5	20
		30°	68.5	18
IV, 11th, 1965	Saijô II	22°	73.3	19
		30°	67.3	13
IV, 11th, 1965	Yohei-numa	22°	76.4	20
		30°	72.9	14
IV, 28th, 1965	Yohei-numa	22°	76.6	21
		30°	72.7	21

The number of tentacles was greater in colonies reared at 22°C than in those reared at 30°C.

Observation 2

Material: – The spinoblasts produced from one colony from the reservoir Saijô II
Vessels used: – 7.5 cm in diameter, 6.0 cm in height in groups A and C,
9.0 cm in diameter, 7.5 cm in height in group B
Rearing method: – One ancestrula was put into each vessel of group A on February 4th, and two ancestrulae were put into each vessel of groups B and C. They were reared at 13°C and 22°C from February 4th to April 1st, '65.
Result: – The number of tentacles is shown in the following table.

Group	Temperature	Tentacles	Number of readings
A	13°C	63.0	12
	22°	70.3	20
B	13°	62.7	22
	22°	69.2	30
C	13°	60.0	5
	22°	70.0	20

The number of tentacles was greater in colonies reared at 22°C than in those reared at 13°C.

Observation 3

Material: – The colonies from the reservoir Saijô II
Vessels used: – 7.5 cm in diameter, 6.0 cm in height
Method: – Three colonies originating from one colony were reared in different vessels at 13°C, 22°C, and 30°C from February 27th to April 30th, '65.

Results: – The results are shown in the following table.

Temperature	Tentacles	Number of readings
13°C	60.6	21
22°	67.5	18
30°	66.1	14

The relation between tentacle number and water temperature agrees with that obtained from the two previous observations. The tentacle number is largest at 22°C.

3. THE DIFFERENCE IN TENTACLE NUMBER BETWEEN SAMPLES COLLECTED IN THE FIELD AND THOSE REARED IN THE LABORATORY

1) Material from Higashi Sendai

The spinoblasts collected at Higashi Sendai were reared in the laboratory at 22°C –25°C. On July 28th, '52, the number of tentacles was compared with that of the field material collected on the same day. The number of tentacles was;

	Mean	Confidence interval of the mean in 75% reliability	Number of readings
Reared material	78.4	77.6-78.7	53
Field material	84.2	83.8-84.7	51

The water temperature in the reservoir did not fall below 24°C from July 20th. This fact suggests that the tentacles decrease in number when the colonies are reared in the laboratory.

2) Material from Yohei-numa

The following observation was made in Aomori City.

Observation 4

Material: – The colonies were collected from a sunny part of the reservoir on July 24th, '64. They grew on the stem of an emerged plant, *Scirpus maritimus*.
The luxuriant colonies were embedded in a thick gelatinous ectocyst, which was about 0.5 cm in thickness, and extended down the stem from 10–50 cm below the water surface. Judging from the continuous gelatinous mass of ectocyst, the colonies on one stem of the plant, seemed to be those from one colony.
Method: – One large colony on the stem of the plant was taken and reared in the laboratory at 22°C. In the second generation, one colony was divided into two pieces, and each piece was put in a different vessel and reared at 22°C and 30°C. The water was renewed once a day with pond water to which protozoans were added.
Vessels used: – 7.5 cm in diameter, 6.0 cm in height
Result: – In the field material, the mean of the tentacle number was 85.5 (number

of readings 24), and it was 76.6 (number of readings 20) in the reared material on October 10th, '64. In the second generation, it was 76.6 at 22°C, and 72.7 at 30°C on April 28th, '65. The tentacles decrease in number at high temperature, and this result agrees with the result of Observation 1.

It is a noteworthy fact that the tentacle number at 22°C was 76.6 in the reared materials of both the first and the second generations. But that of the field material was 85.5 although the water temperature of the reservoir did not fall below 22°C from July 18th.

From these results, it may be concluded that the tentacles decrease in number when the field material is reared in the laboratory.

4. THE INFLUENCE OF WATER VOLUME ON TENTACLE NUMBER

As well as water temperature, other factors such as the volume of water, the kind and quantity of food and the pH, might be the cause of the variation in tentacle number mentioned above. To solve this problem, the following observation was made on the relation between the tentacle number and the volume of water.

Observation 5

Material: – The colonies from the reservoir Saijô II

Rearing method: – To remove the effects of differences of temperature, a small vessel, 7.5 cm in diameter and 6.0 cm in height, was put inside another larger one, 25 cm in diameter and 10 cm in height. The depth of the water was 5.5 cm in the small vessel and it was kept at the same level as that in the outer vessel. The volume of water in the inner small vessel was about 240cc and that of the outer 2020cc. The water was renewed once a day with pond water containing cultured protozoans. The rearing temperature was 22°C.

(a) One colony was divided into two pieces and one piece was put in the inner small vessel and the other in the outer large vessel on December 4th, '64.

Result: – After 23 days (December 27th), the two groups were examined. The

	Date examined	Vessel	Originel number of colonies	Number of colonies	Tentacles	Number of readings
(a)	XII, 27th, 1964	Small	1	2	72.0	23
		Large	1	8	76.1	47
(b)	I, 22nd, 1964	Small	1	2	72.7	20
		Large	1	6	74.5	38
(c)	II, 10th, 1965	Small	1	2	73.9	30
		Large	1	7	76.7	50
(d)	II, 20th, 1965	Small	3	3	74.7	34
		Large	1	6	76.3	36

colonies had increased in number as shown in the table. The tentacles were fewer in the small than in the large vessel.

(b) From December 27th, a piece of the colony from each vessel was reared till January 22nd, '65. The result agreed with that of (a).

(c) On January 22nd, one colony of the six in the outer vessel was divided into two and they were put in different vessels. The tentacles were examined on February 10th. The result agreed with that of (a).

(d) On February 10th, four colonies among the seven in the outer vessel were taken out. Among them one colony was put in the outer vessel and the other three in the inner small vessel. Ten days later, they were examined. In this observation, the difference between the two groups was not so large as those of the case of (a)-(c). During these ten days one colony of the outer vessel grew into six colonies, but in the inner small vessel, the colonies did not increase in number.

The tentacle number decreased in the small vessel. This shows that the number of tentacles is directly related to the capacity of the rearing vessel when the temperature is constant.

5. THE RELATION BETWEEN THE NUMBER OF TENTACLES AND THE NUMBER OF COLONIES

1) In Observation 5, the colonies of the inner and the outer vessel differed in number in all cases. In (a)-(c), one colony grew into two in the small vessel but in the outer large one, the colonies increased to 6, 7 and 8 in number. In (d), the colonies in the small vessel did not increase in number, but in the outer large one, one colony grew into 6 colonies. In all the cases, the tentacles in the inner small vessel were fewer than in the larger one. These results suggest that the volume of water for each colony may be related to the tentacle number. The following observation was made to solve this problem.

Observation 6

Material: – From Saijô II

Vessels used: – 7.5 cm in diameter, 6.0 cm in height

Rearing method: – The colonies from one colony were reared at 22°C from January 25th to February 10th, '65. In this observation, a different number of colonies was put into the different vessels.

Result: – In vessels 5 and 6, there were nine colonies and the tentacles were fewer than those of the others. The number of colonies did not change and this result agreed with those of the previous observations.

It should be noted that the materials Nos. 1–4 did not show a marked difference in tentacle number in spite of that a difference was seen in colony number. When the size of the colonies was examined, differences were apparent. The colonies of Nos. 1–4 were larger than the others in size, and the number of polypides in one

Original number of colonies	Number of colonies on II, 10th	Total number of polypides	Tentacles	Number of readings
1	2	36	75.9	20
1	3	47	75.7	32
1	3	48	75.7	29
1	4	51	74.0	32
9	9	66	73.3	38
9	9	78	72.4	33

colony was apparently large. Thus the number of tentacles decreases with an increase in the number of polypides. A similar observation was made on the material from the reservoir Saijô II.

Observation 7

Method: – On January 25th, '65, some spinoblasts were taken from one colony, and the ancestrulae germinated from them were reared at 22°C till February 20th.
Vessels used: – 7.5 cm in diameter, 6.0 cm in height
Result: – A high and inverse correlation was recognized between the number of tentacles and the number of polypides. The tentacles decrease in number with an increase in polypide number. It may be said that the number of tentacles is influenced by the volume of water available to each polypide.

Number of ancestrulae	Number of colonies on II, 20th	Total number of polypides	Tentacles	Number of readings
1	2	43	71.4	29
1	2	44	72.3	33
1	3	48	69.6	31
1	3	50	71.2	27
3	3	55	70.2	28
5	5	62	68.1	32
5	5	68	68.3	33
7	7	85	67.4	35

6. DIFFERENCE OF TENTACLE NUMBER BETWEEN TWO INTRASPECIFIC GROUPS

The intraspecific groups showed differences in their tentacle number (1964, Reports VI and VIII), when they were reared under the same conditions. The possible causes of this difference are: –

a) The groups differ in the number of polypides and thus, the tentacles of each group show secondarily a difference in number.
b) The number of polypides is similar among the groups but their tentacles differ in number.

To solve this problem, the following observation was made.

Observation 8

Materials: – Those from the reservoirs, Saijô II and Yohei-numa
Method: — Some spinoblasts were taken from one colony of each material. One ancestrula was put in vessel A, four ancestrulae in vessel B, and eight ancestrulae in vessel C. The rearing conditions were similar to those mentioned above at room temperature. The colonies were examined on August 5th.
Result: – In spite of a similar number of polypides, the number of tentacles was larger in the Yohei-numa material when compared with that from Saijô II.

Material	Number of ancestrulae	Number of colonies on VIII, 5th	Total number of polypides	Tentacles	Number of readings
Saijô II	1	6	66	72.5	22
	1	5	56	71.1	17
	4	6	91	70.5	24
	8	12	95	68.9	24
Yohei-numa	1	3	60	76.4	22
	1	3	67	78.8	21
	4	8	94	75.7	22
	8	9	89	74.0	25

As seen in this table, the two intraspecific groups differ in number of the colonies, but they do not show so large a difference in the total number of polypides. The tentacles of the Saijô II material are less numerous.

A similar result was obtained from another observation made at a different water temperature.

Material	Number of ancestrulae	Number of colonies on VIII. 5th	Total number of polypides	Tentacles	Number of readings
Saijô II	1	6	63	70.4	23
	1	8	73	66.4	28
	4	12	77	70.0	23
	4	10	86	67.2	20
Yohei-numa	1	3	57	79.9	21
	1	3	66	76.0	21
	4	4	79	75.6	22
	4	4	84	77.3	22

These results prove that the difference of tentacle number among the intraspecific groups is not related to the number of polypides, but is a hereditary character of the polypide in each intraspecific group.

SUMMARY

1. The tentacles decreased in number when the colonies were reared at a water temperature of 30°C, and also decreased at 13°C.

2. The tentacles decreased in number when the field materials were reared in the laboratory.

3. The tentacle number was directly related to the volume of water. When the volume of water for a polypide was large, the tentacles were numerous.

4. The difference of tentacle number among the intraspecific groups is not related to the number of polypides, but is a hereditary character of the polypides in each intraspecific group.

LITERATURE CITED

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